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The ARL Army Experiment 3 Individual Combatant/Military Operations on Urbanized Terrain (MOUT) Demonstration

by Mark A. Thomas

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The ARL Army Experiment 3 Individual Combatant/Military Operations on Urbanized Terrain (MOUT) Demonstration

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Abstract

In October 1996, the U.S. Army presented a demonstration of wargaming and virtual prototyping at the Annual Association of the U.S. Army (AUSA) Convention in Washington, DC. The demonstration showcased interactive simulation and its use in military operation planning, situational awareness, battlefield coordination, and infantry tactics. The U.S. Army Research Laboratory (ARL) participated by demonstrating infantry tactics in an urban area. The ARL demonstration included dismounted infantry (DI) maneuvering in a built-up area to clear a building, and dynamic effects on terrain and manmade structures. This report describes the ARL military operations on urbanized terrain (MOUT) demonstration.

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1. Introduction

In October 1996, the U.S. Army presented a demonstration of future military technologies and virtual simulation. Named the Army Experiment 3 (AE3), live, constructive, and virtual simulations were integrated to demonstrate the use of simulation in military acquisition, planning, and coordination. The technologies involved in the AE3 included wide area networking, distributed interactive simulation (DIS), dismounted infantry (DI), military operations on urbanized terrain (MOUT), and virtual prototyping. The demonstration brought together Army assets from industry, Army schools and centers, and research laboratories.

The U.S. Army Research Laboratory (ARL) participated in the exercise with its DIS, dynamic terrain, and weapons effects on buildings. The DI scenario presented virtual soldiers maneuvering and fighting in a simulated urban environment. The simulation showcased ARL simulation techniques in DIS, real-time weapons effects modeling, and dynamic terrain research. This report will describe the ARL DI scenario and the exercise setup to perform the simulation.

2. Scenario

The ARL DI demonstration showed the tactical scenario of DI covering a demolition expert who maneuvers to a building and emplaces an explosive charge. While the DI maneuvered to the building to clear it through the hole blown into it by the explosive charge, a Bradley fighting vehicle maneuvered through a crater formed from enemy artillery fire.

The ARL DI scenario was a 30-s vignette. The scenario involved four dismounted soldiers clearing a building in an urban area. The urban area was a model of the McKenna MOUT site at Fort Benning, GA (Figure 1). One soldier emplaced an explosive on the side of a building, while the others provided covering fire. When the explosive fired, it blew a hole into the side of the building. The soldiers then maneuvered to the hole, and two soldiers entered to clear the building while the

Figure 1. McKenna MOUT Site.

others provided covering fire and overwatch. Simultaneously, a Bradley fighting vehicle moved up the road next to the building and maneuvered through a crater formed from enemy artilley fire. The scenario required exact timing of events to conform to the requirements of the AE3 scenario.

The simulation was displayed on three 12-ft × 12-ft screens. Two screens displayed the DI action, and the third screen showed a view of the Bradley maneuverin through the dynamically formed crater.

3. Exercise Setup

The ARL demonstration used the ARL STEALTH, ModSAF, and the ARL DIS manager software. The ARL STEALTH (STEALTH) displayed the simulated environment, controlled the eye-point of the viewer, and animated the DI icons. In addition, STEALTH displayed the dynamic crater and the explosive effects and the hole in the building. ModSAF was used to run the Bradley fighting vehicle and fire the artillery barrage that produced the crater. The ARL DIS manager was used for wide area networking using the DIS protocol.

The demonstration involved controllers at the ARL, Aberdeen Proving Ground, MD site and the show floor at the Sheraton in Washington, DC. The APG site controllers operated a ModSAF and STEALTH. The ModSAF controlled two Bradley fighting vehicles and the enemy artillery barrage. The APG site STEALTH was a mirror of the STEALTH at the Sheraton.

The Washington STEALTH operators controlled the eye-point of the simulation using the mouse and keyboard controls of the STEALTH viewer. In addition. they were responsible for resetting the simulation between scenario runs (Figure 2).

Figure 2 shows the equipment and software used. The equipment is in regular type, and the software is in bold type.

The Sheraton STEALTH controlled the three large screen displays. STEALTH used a single graphics pipeline with three channels. The *ircombine* utility on the SGI Infinite Reality was used to configure the screen placement.

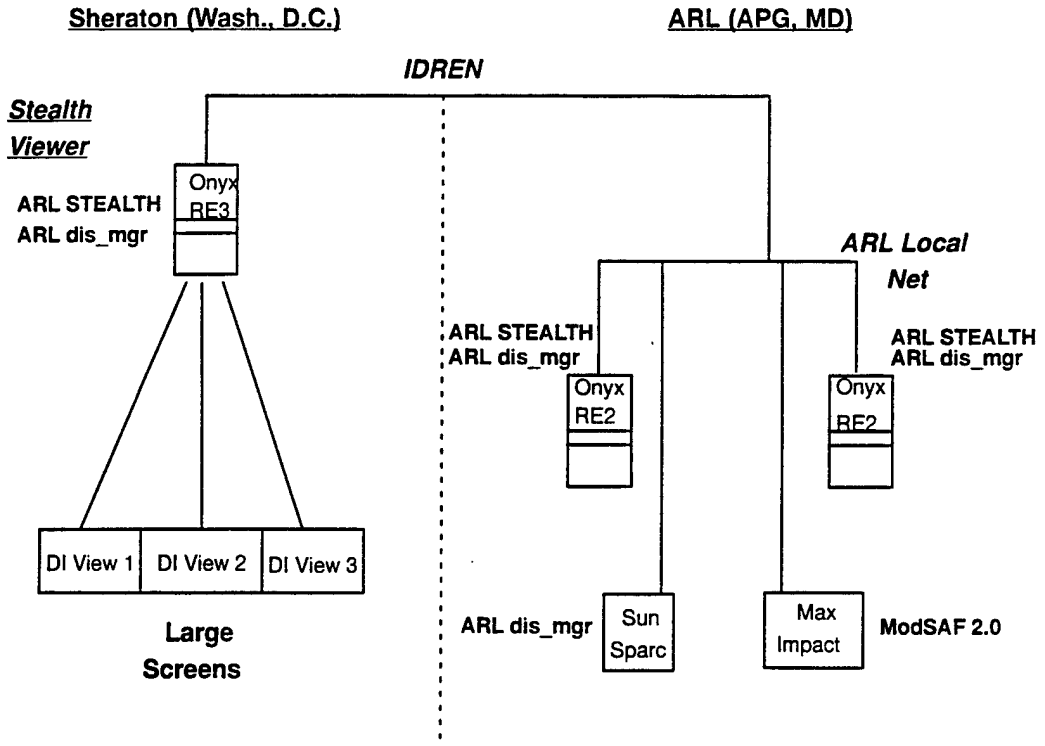

Figure 2. ARL DI Simulation Test Setup.

4. Dismounted Infantry Simulation

To display the dismounted infantry action, the Boston Dynamics DI-Guy icon was used. DI-Guy was selected for its smooth infantry animation and compatibility to existing DIS lifeform enumerations. The DI-Guy DIS interface recognizes DIS enumerations for soldier actions such as walk, run, weapon deployed, stand, kneel, and crawl. DI-Guy provides a programmer interface to control the icon. The programmer may control the head and weapon, and the icon's body will move

appropriately for realistic animation of the desired motion. In addition, the icon's gait can be controlled using speed as a parameter.[1]

Because of the tight sequencing of the scenario, ModSAF was not used for DI simulation, and DIs were controlled using the STEALTH. To animate the icon, the path following utility of the ARL STEALTH was employed. The path following utility of STEALTH uses an ASCII file, which contains directions on how the path should be traversed. The path may include pauses and delays, and azimuth may be given for pauses, allowing the soldier to stop and turn in a direction different from the direction of motion.

The path file also includes a field for icon specific information. The DI-Guy interface uses a discrete identifier for icon actions. This identifier was used in the path files to direct the motion of the icon. The following is the path file for the demolition DI.

```
START 1494.5 1594.5 0.0
PAUSE 0. 1 35.0 0
LEG 1494.5 1594.5 0.0 3.20 11 1492.0 1603.0 0.0
LEG 1492.0 1603.0 0.0 3.20 11 1490.8 1602.5 0.0
PAUSE 1.5 125.0 1
PAUSE -1.0 125.0 0 /* EMPLACE THE BOMB
PAUSE 0.25 125.0 0
PAUSE 0.25 215.0 0
LEG 1490.8 1602.5 0.0 3.2 11 1494.0 1592.0 0.0
PAUSE 2.5 35.0 3
LEG 1494.5 1592.0 0.0 3.2 11 1492.0 1601.7 0.0
PAUSE 15.0 269.0 4
LEG 1492.0 1601.7 0.0 1.2 11 1494.5 1594.5 0.0
PAUSE 15.0 35.0 4
```

Icon speed was computed offline with separate path generation software. This speed was then correlated with the DI-Guy icon to prevent the skating motion that results when speed over ground is faster than the icon's gait. Figures 3–7 show an animation of the DI building clearing attack.

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[1] Boston Dynamics Inc. "DI-Guy Software for Dismounted Infantry Reference Manual Version 2.01." One Kendall Square, Bldg 100, Cambridge, MA, 20 September 1996.

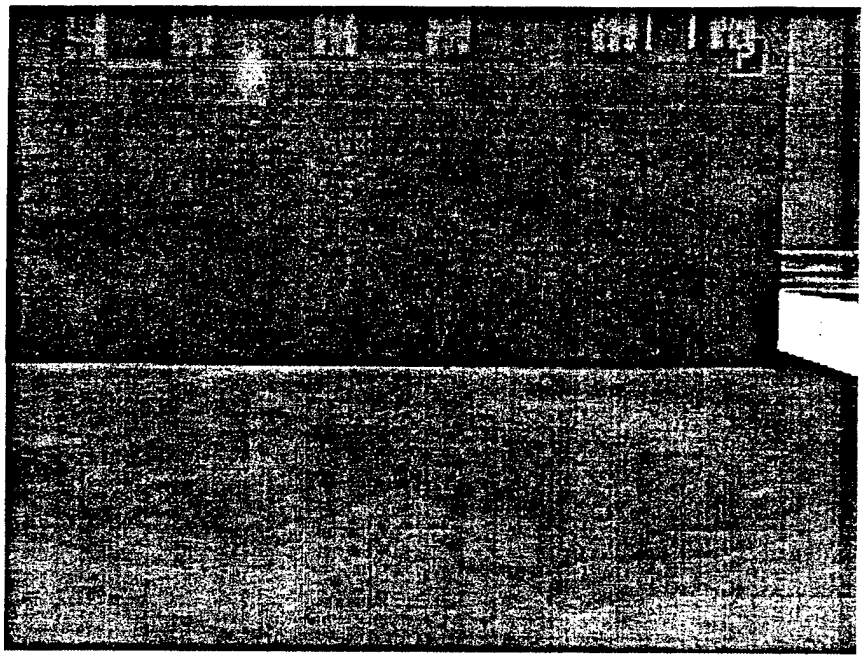

Figure 3. Side of Building.

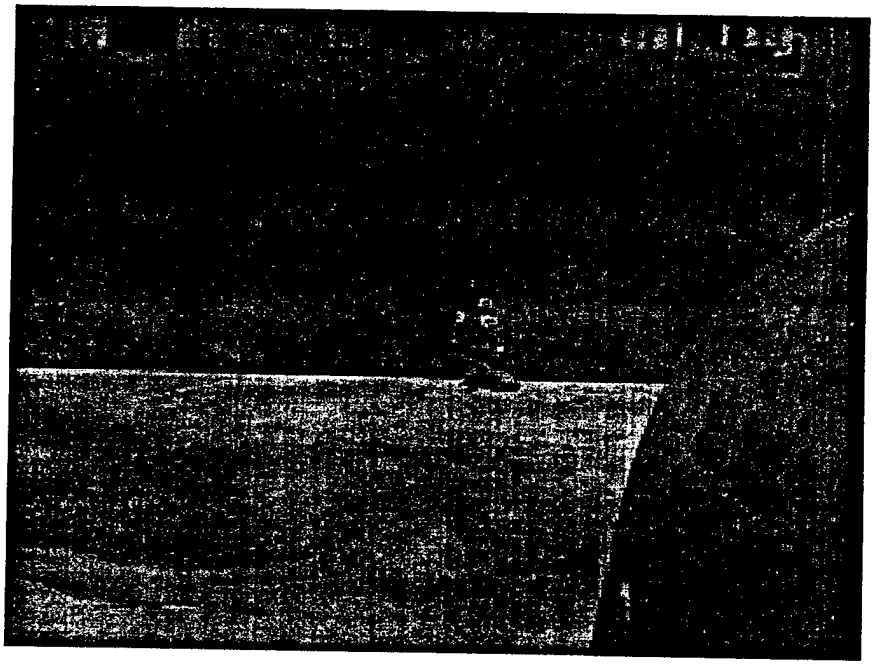

Figure 4. DI Emplacing Charge Demolition Device.

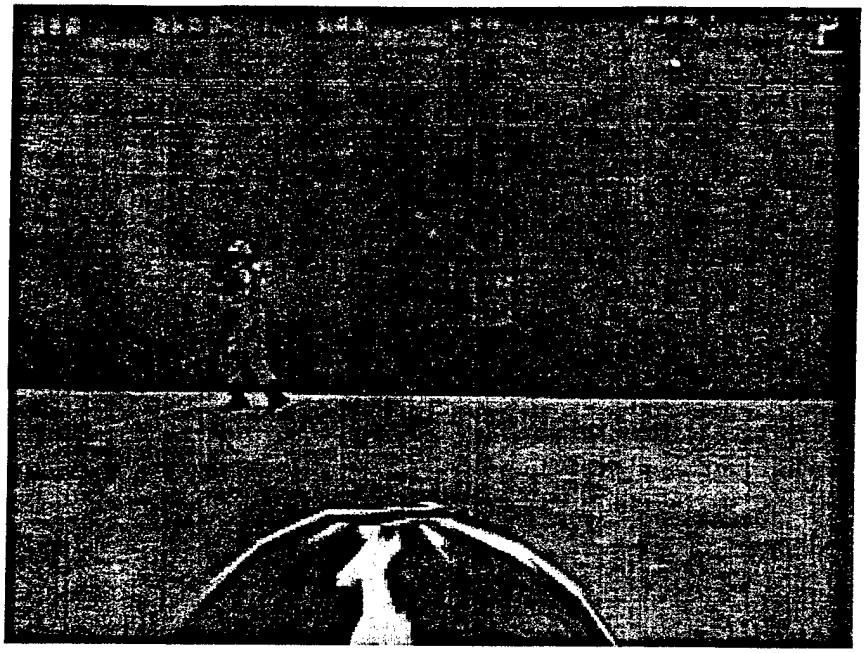

Figure 5. Demolition Device Emplaced on Building.

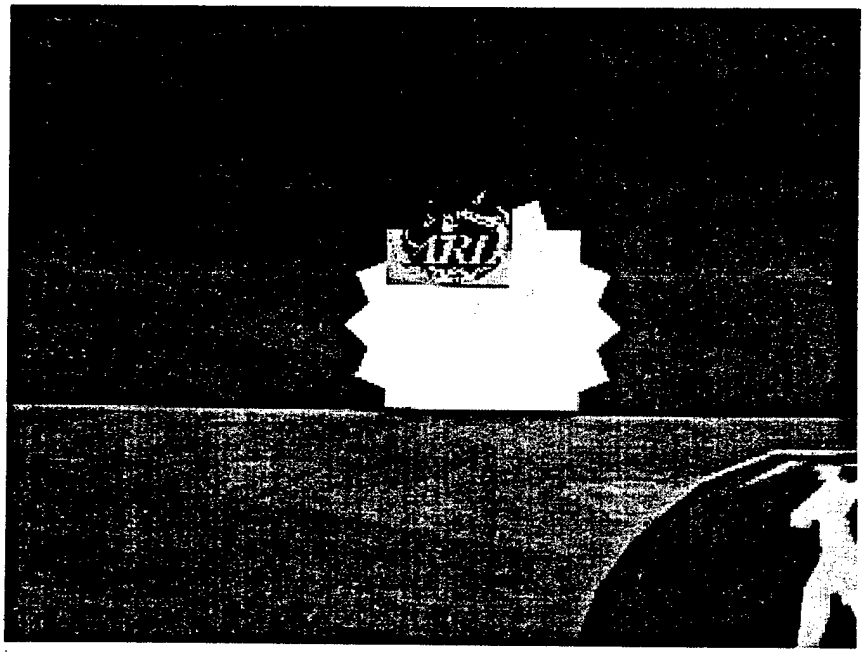

Figure 6. Hole Created From Demolition Device Detonation.

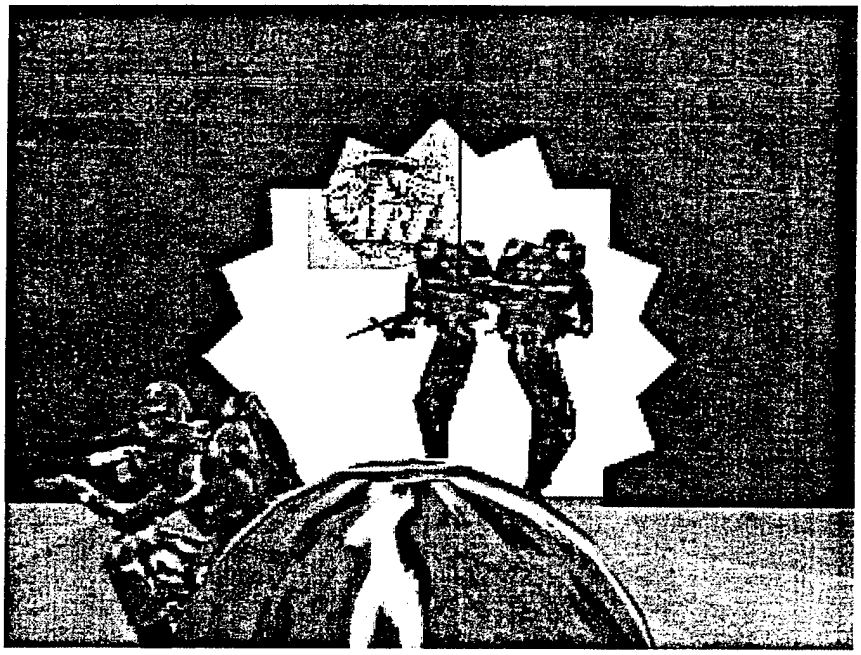

Figure 7. DI Entering and Clearing Building.

5. Dynamic Terrain Simulation

The dynamic terrain (DT) demonstration showed a Bradley infantry fighting vehicle (BIFV) traversing a crater formed by enemy artillery fire. The crater was formed in a segment of a road. The road was extracted from the McKenna MOUT database and gridded at 0.25-m resolution. The road segment was then loaded into STEALTH separately from the rest of the terrain database. At run-time, when a detonation event occurred on the road segment, a crater was computed and the terrain morphed to insert the crater formed (Figures 8 and 9).

The DT simulation was controlled by ModSAF. At the beginning of the scenario, ModSAF executed a Call For Artillery Fire. A Detonation Protocol Data Unit (DPDU) was created and transmitted over the network. When the DPDU was received by the STEALTH viewers, the crater was computed and displayed (Figure 10). At the same time, the Bradley was started on its way to pick up the DIs in the village and traversed the crater en route.

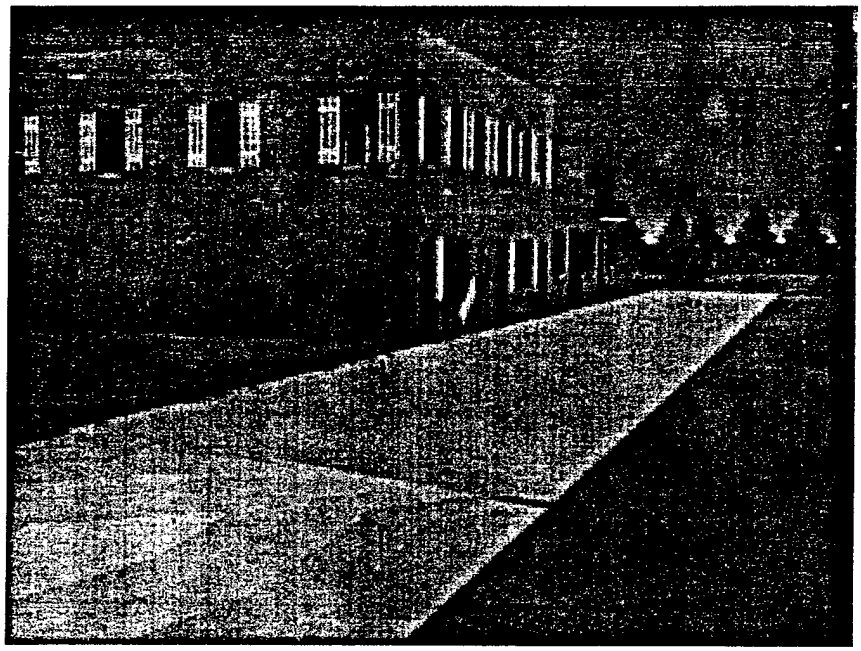

Figure 8. McKenna Mout Site Road.

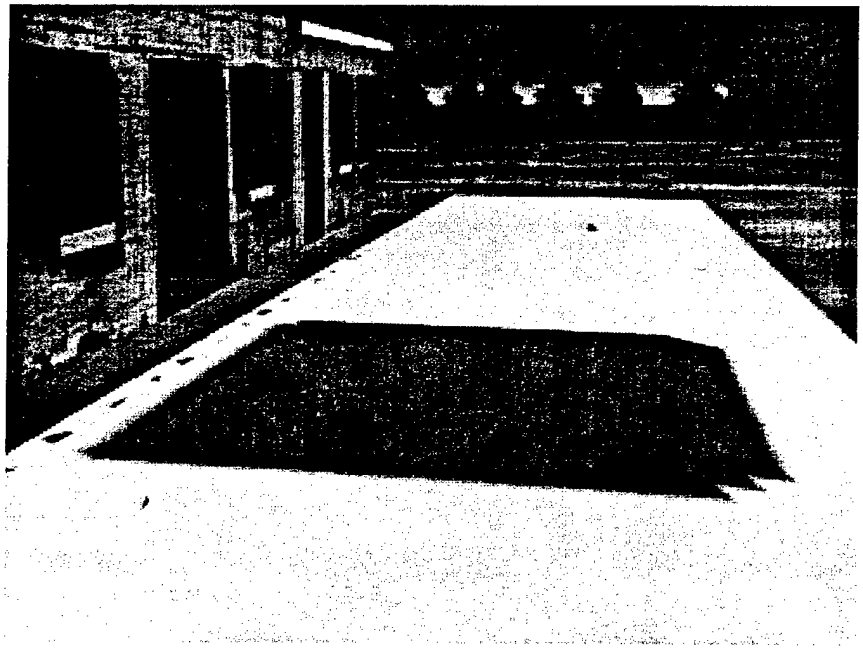

Figure 9. Road With Dynamically Created Crater.

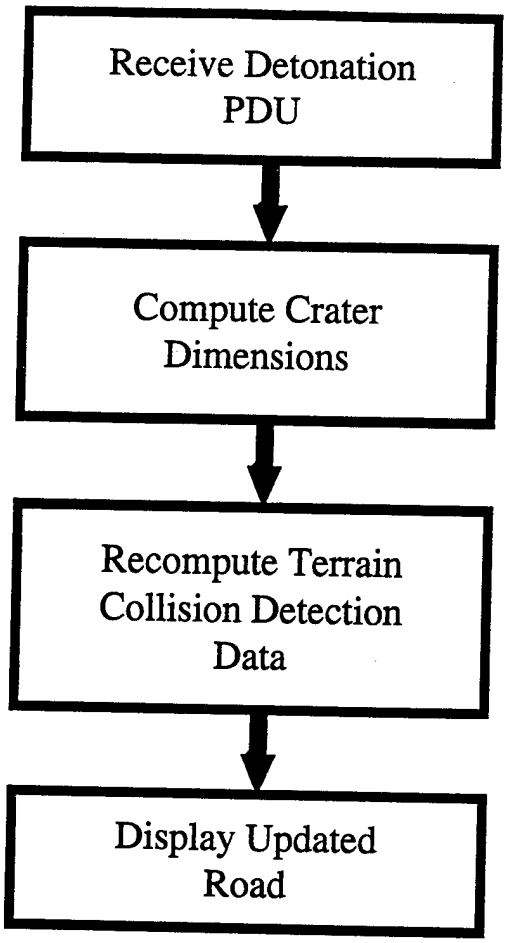

Figure 10. Process Flow for Dynamic Terrain.

6. Conclusion

This report describes the ARL DIS for the AE3 at the AUSA show in Washington, DC, during October 1996. The demonstration showed how simulation could be used to show a realistic urban environment in which to train infantry urban warfare tactics. The ability to blow a hole into a wall, providing ingress to a building, and dynamic cratering are important considerations for infantry tactics and were demonstrated successfully during the AUSA show.

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